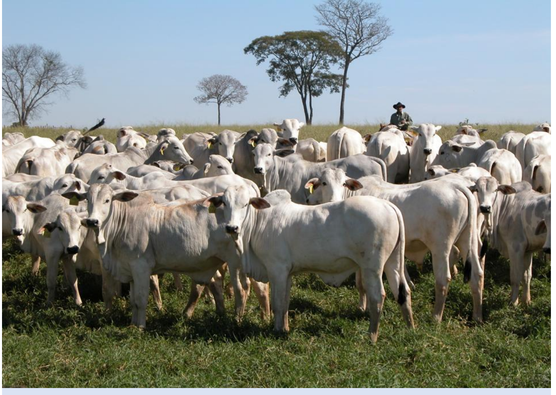

Calpain and calpastatin markers associations on growth, ultrasound measures and feed efficiency traits in Bos indicus cattle (Nellore)

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Objectives

The objective of this research was to verify the association of genetic markers discovered in the calpain and calpastatin genes with growth, feed efficiency and ultrasound carcass traits in Nellore beef cattle.

Introduction

The Nellore breed has strong influence in more than 150 million animals of the Brazilian herd and it is essential to validate the relationship among genetic markers with economically relevant traits in that beef breed. The calpain-calpastatin system is one of the most relevant proteolytic systems in mammals. In vivo, those proteases can affect protein synthesis and degradation processes, thereby energy expenditure and body protein gain can be altered.

Methods

Phenotypic and genotypic information was obtained of 290 Nellore bulls and steers evaluated in feeding trials. Animals were raised under grazing (primarily *Brachiaria spp*.) conditions until approximately 18 months of age and then were allotted to feedlots and fed medium energy level diets, individually, for 56 to 84 days. Thirteen traits related to growth, feed efficiency and ultrasound carcass measurements were taken for all animals, that were, also, genotyped for CAPN4751 (C/T, 6545 bp of AF248054) and UoGCAST (C/G, 282 bp of AY008267) in the calpain and calpastatin genes, respectively.

Gene and genotypic frequencies for each marker were estimate by simple count of different alleles and genotypes, using PROC FREQ from SAS (SAS, 2004). Association analyses between SNP and traits were conducted with PROC MIXED. Association analysis between SNP and traits were carried out using a mixed model:

$$Y_{ijklmn} = \mu + CG_i + S_j + M_k + \alpha_1(age) + \alpha_2(days\ on\ feed) + si_m + e_{ijklmn}$$

where Y_{ijklmn} = the phenotypic value of trait; μ = the general mean of the trait; CG_i = the fixed effect of contemporary group; S_j = the fixed effect of sex (steers and bulls); M_k = marker effect; α_1 = the coefficient of covariate of age at the measurement; α_2 = the coefficient of covariate of days on feed; si_m = the random effect of sire $(0,\sigma_s^2)$ and e_{ijklmn} = random residual $(0, \sigma_e^2)$. Days on feed was not significant; therefore excluded from model. Additive and dominance effects were, also, estimated.

Results

The descriptive statistics of traits analyzed are presented in Table 1.

Table 1 – Abbreviations, overall traits means and standard deviation (SD) in experimental cattle

Trait	Abbreviation	Average	SD
Age, days	-	666	65
Mid-test BW, kg	BW	428	46
Dry matter intake, kg/d	DMI	9.52	1.38
Metabolizable energy intake, Mcal/d	MEI	23.7	3.4
Average daily gain, kg/d	BWG	1.51	0.38
Gross feed efficiency, kg/kg	GFE	0.159	0.034
Feed conversion ratio, kg/kg	FCR	6.60	1.56
Partial efficiency of growth, g/kg	PEG	0.315	0.091
Residual feed intake 1, kg/d[1]	RFIa	0.00	1.03
Residual feed intake 2, kg/d[1]	RFIw	0.00	0.70
Ultrasound rib eye area, cm^2	UREA	71.7	9.1
Ultrasound rib eye area, $cm^2 100kgBW^{-1}$	UREA/BW	0.151	0.015
Ultrasound backfat thickness, mm	UBFT	3.81	1.58
Ultrasound rump fat thickness, mm	URFT	6.47	2.52

[1] RFIw = residual feed intake computed within contemporary groups; RFIa = residual feed intake computed across contemporary groups.

Statistically significant effects of CAP4751 were detected in final body weight (486 vs. 473 kg, P=0.03), average daily gain (ADG, 1.53 vs. 1.44 kg/d, P=0.04) and ultrasound backfat thickness (7.5 vs. 6.70 mm, P=0.04).

An important effect of the marker UoGCAST on ADG (-0.0685±0.026 kg/d, P=0.0093) was identified.

Conclusions

UoGCAST and CALP4751 markers can affect growth and carcass traits in Nellore cattle but not feed efficiency.

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